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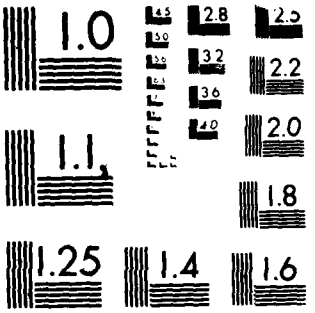

MODIFICATION OF THE NRL 19.3 GHz RESEARCH RADIOMETER

JAYCOR Report Number J206-82-013/1237

JAYCOR

205 South Whiting Street
Alexandria, Virginia 22304

JAYCOR

(1)

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JAYCOR Report Number J206-82-013/1237

August 30, 1982

FINAL REPORT

by Ben G. Julian

Prepared for:

Naval Research Laboratory
4555 Overlook Avenue, SW
Washington, DC 20375

Under:

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MODIFICATION OF THE NRL 19.3 GHz RESEARCH RADIOMETER

The Navy has a great interest in remotely sensing the sea state and relating it to the surface winds. At microwave frequencies, it has been suggested that sea surface observation can be related to surface winds. NRL has designed and built a 19.3 GHz radiometer to investigate this relationship and determine its usefulness. JAYCOR has supported this development over the past several years and this report addresses the latest series of modifications to the instrument.

This Final Report is a summary of the work performed. Detailed drawings, sketches and notebooks have been supplied to and accepted by the COTR in their original state as required by CDRL Item Numbers A001, A002 and A003. Reduced copies of the drawings are given in the Appendix.

The radiometer consists of three subsystems:

- passive microwave receiver
- control box
- electrical cable assemblies for power input, data out and function control.

The modifications performed enhanced the field ability of the radiometer and did not modify its basic conceptual design. The following paragraphs describe specific modifications performed.

HANDLES

The Receiver Radiometer weighs approximately 23.5 kg (54 lbs). To facilitate transporting the unit in both the laboratory and field, carrying handles were added. The weight balance point (front to back) was determined and the carrying handles were placed above this point at the top of the side panels.

TEMPERATURE READOUT CIRCUIT

The temperature readout control panel or board for the receiver was relocated. A protective cover over the panel was designed to protect the circuits and/or personnel.

AIR BLOWER (Receiver)

The mount to hold the air blower was redesigned and changed to improve circulation of air, to give better bracing against shock and vibration, and a more satisfactory mounting for the blower.

ELECTRICAL CONNECTING TERMINAL BOARD (Receiver)

All electrical wires for the components are brought to a central board for interconnecting. This group of terminal blocks was relocated and redesigned to give more space between it and the side panels and to improve accessibility for circuit tracing and testing.

WAVE GUIDE (Receiver)

The wave guide used in the microwave measuring circuits was relocated, redesigned and shortened, where convenient, to improve placement, straight runs between components and to eliminate several bends and elbows.

AIR TEMPERATURE SENSOR (Receiver)

The temperature sensor for measuring the temperature of the air inside the radiometer was relocated to give a better and more true reading and to improve control. It was also thermally insulated from the inside chassis.

INSIDE CHASSIS (Receiver)

To further protect the receiver components from possible thermal gradients, the internal chassis was thermally insulated from the outside frame of the instrument. The insulation used was styrofoam plastic and bakelite impregnated cloth.

INSTRUMENT MOUNT

The prime use of this instrument is measuring the microwave electromagnetic radiation from the surface of ocean water. This water surface should not be disturbed by the oceanographic ship nor an instrument platform located in the water, whichever is used.

In the case of a ship, the bow wave formed by passage of the

ship, is dependent on the ship's speed and the weather conditions. If an instrument platform is used, waves splash against the sides or legs, causing reflected waves and foam.

To be able to measure the radiation from undisturbed water, an instrument mount was designed and built for use on a ship or instrument platform. It would fasten to the pipe rails or bulwarks. To aim the receiver at the undisturbed water beyond the bow wave, or reflected wave to be measured, the instrument mount was designed to tilt, from 10 degrees above the horizon to 90 degrees below the horizon (90 degrees nadir). Tilt was fixed in increments of 5 degrees. The instrument platform was also adjustable in rotation in 5 degree steps from 90 degrees to the ship's longitudional axis to 60 degrees either side of the above center point. Using tilt and rotation, undisturbed water can be measured, and also different angles on incidence can be used, as these also affect the instrument reading.

The instrument mount was designed so that it could be disassembled into small, flat sections for ease of packing and shipping. The metal used in this mount was finished with an Iridite finish which is resistant to salt water corrosion.

SUN SHIELD

As it was designed, the internal temperature of the air and the components are kept constant inside the Radiometer Receiver. This is necessary to obtain accurate data. This constant stable temperature is above the normal ambient and laboratory temperatures.

When the Receiver is in field use, as on a ship or research tower, it can be and frequently is in direct sunlight. With the sun's heat beating down on the external walls of the receiver, a small amount of heat is gradually transferred inside through the walls, although the walls are insulated with styrofoam bead foam plastic. With this heat added to the inside of the instrument, soon the internal temperature goes beyond the point where it can be controlled by the built-in system. After the temperature becomes unstable and uncontrolled, the data is not usable.

The sun shield design was a U-shaped cover, closed on top and back and open at front and bottom. In operation, it was placed over the

top and sides of the receiver. The sun shield has a layer of foam plastic on its inside surface to prevent secondary radiation. Spacers consisting of rods and blocks left an air space between the sun shield and the receiver for air passage. The sun shield was so designed that it was well anchored against winds and storms and would not affect the instrument at any tilt or rotational angle.

For transport or shipment, the sun shield is disassembled into small flat sections, easily and compactly packed. The metal was given an Iridite finish to protect against salt water corrosion.

RAIN SHIELD, TYPE A (Non-Operation of Receiver)

As the Radiometer Receiver is not waterproof, a rain shield was designed and built. This shield is to completely waterproof the receiver against rain and storms. It was fabricated from heavy gage flexible vinyl plastic and is box shaped, closed on all sides except the bottom. It is draped over the instrument and laced at the bottom to hold it in place.

RAIN SHIELD, TYPE B (For Operating Receiver in Rain)

This particular rain shield is to put over the receiver allowing operation during rain. It is box shaped, but open at the bottom and with a long, open cylindrical snout in front of the horn lens. It is laced, underneath, from side to side to hold it in place. This protects the instrument from falling rain but not from violent updrafts of rain. This rain shield was also made from flexible heavy gage vinyl plastic sheeting.

SHIPPING CONTAINER FOR RADIOMETER RECEIVER

To protect the receiver when shipping, a special container was designed, with padding against vibration and shock. Special lens protection was provided for the horn lens.

SHIPPING CONTAINER FOR CONTROL BOX. ELECTRICAL CABLE ASSEMBLIES, SPARE PARTS AND ACCESSORIES

A container was custom designed for these units and parts.

SHIPPING CONTAINER-SUN SHIELD

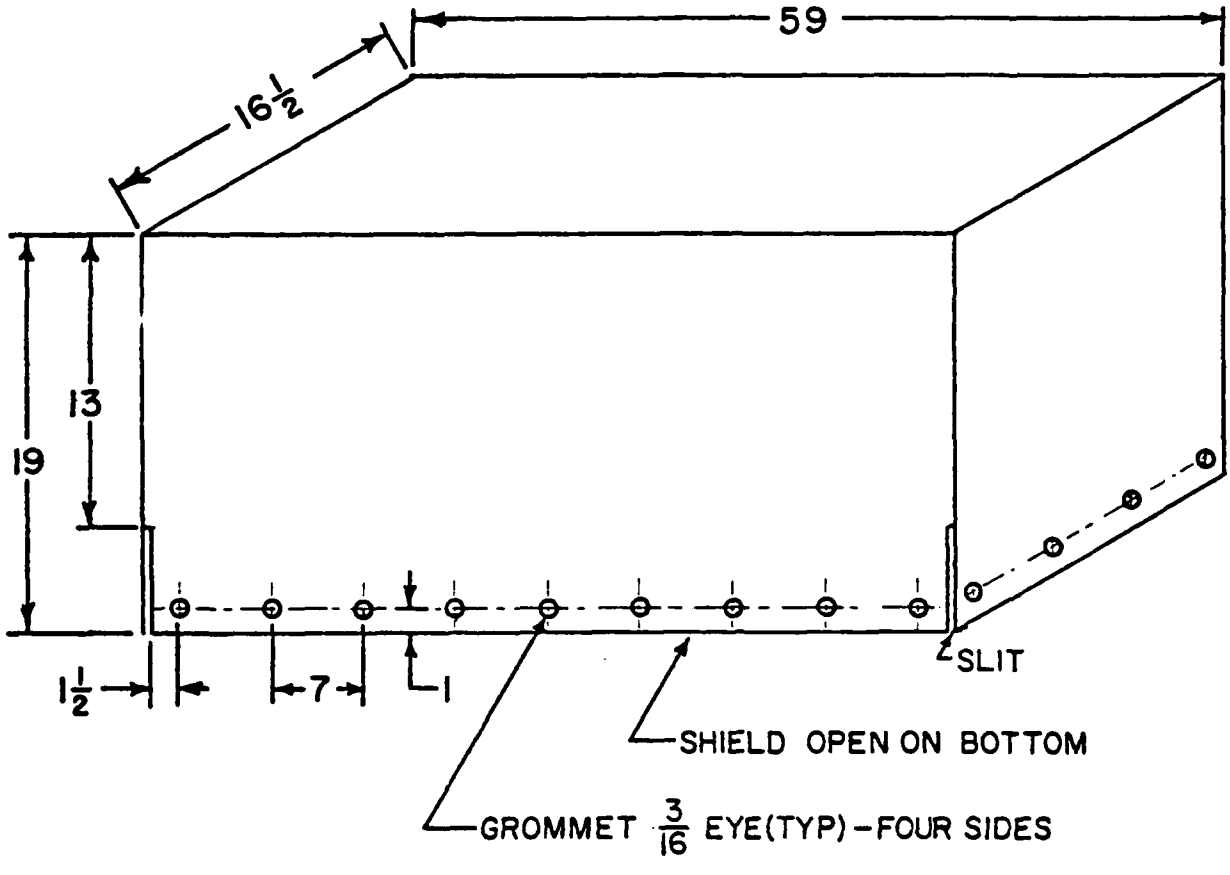
A sun shield container was designed for safe shipment of the device.

SHIPPING CONTAINER FOR INSTRUMENT MOUNT

A box to hold the instrument mount was designed.

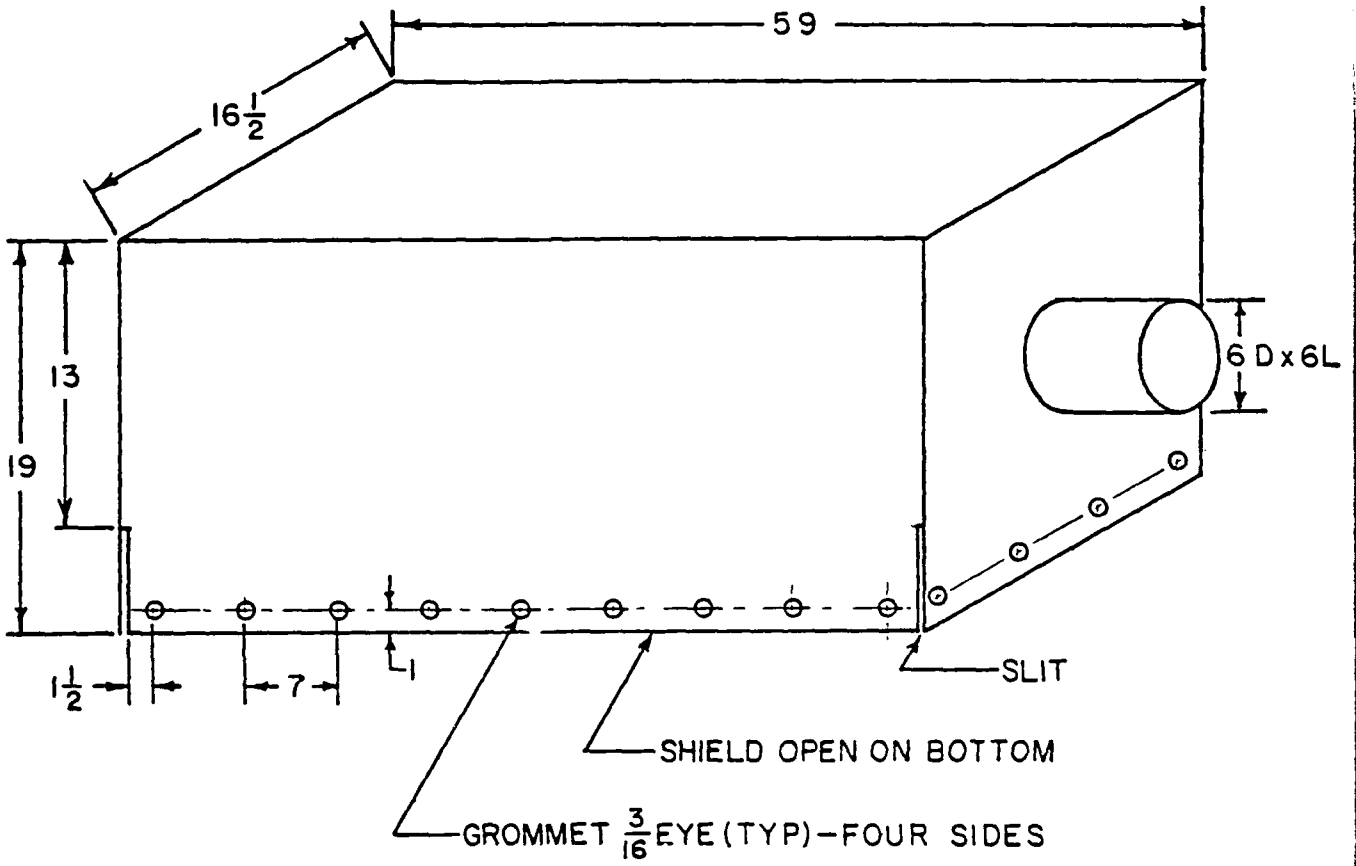
This effort completes the modification required to make the radiometer field usable. The follow-up effort in progress will develop operational and maintenance manuals for the radiometer.

APPENDIX



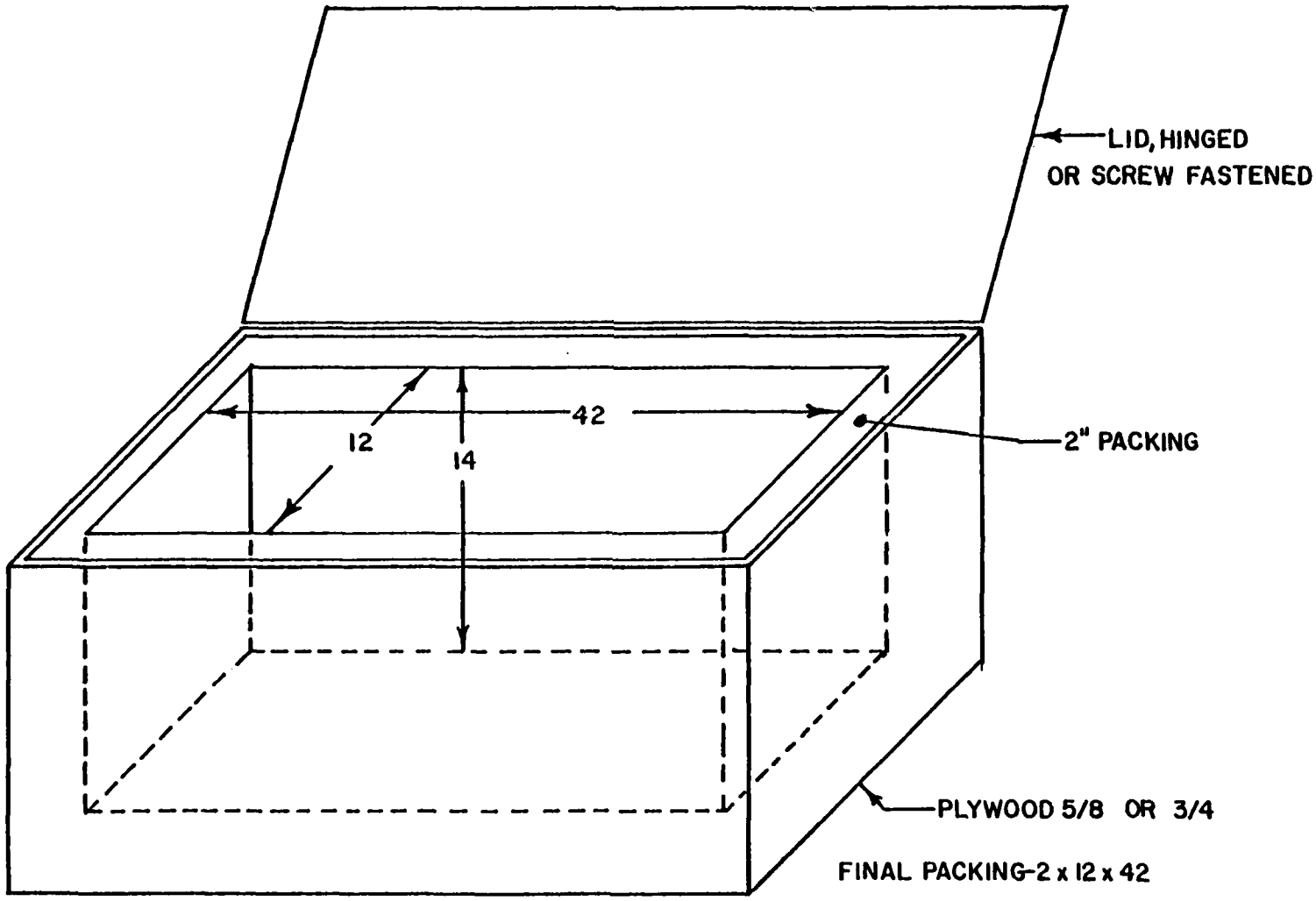
RAIN SHIELD-TYPE A
FOR RADIOMETER RECEIVER

MATERIAL: .010 VINYL SHEETING
HEAT SEALED AT CORNERS

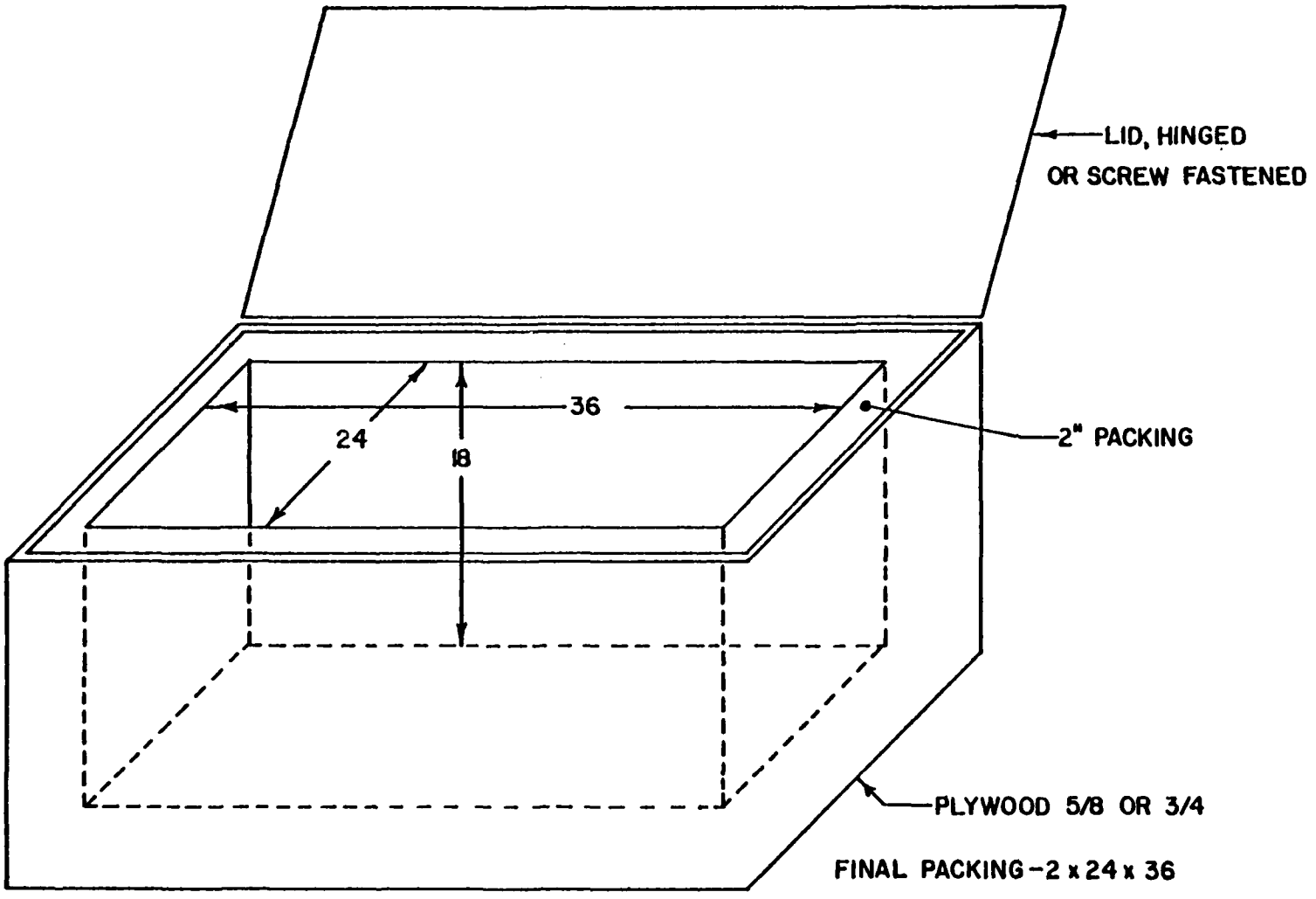


RAIN SHIELD — TYPE B
FOR RADIOMETER RECEIVER

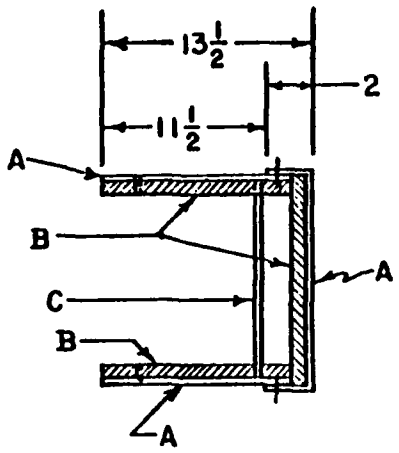
MATERIAL: .010 VINYL PLASTIC SHEETING
HEAT SEALED AT CORNERS

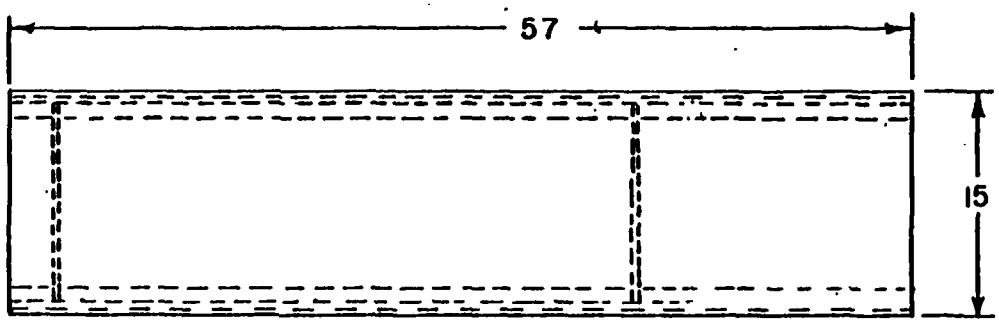


SHIPPING CONTAINER FOR
RADIOMETER RECEIVER



SHIPPING CONTAINER FOR
RADIOMETER ACCESSORIES

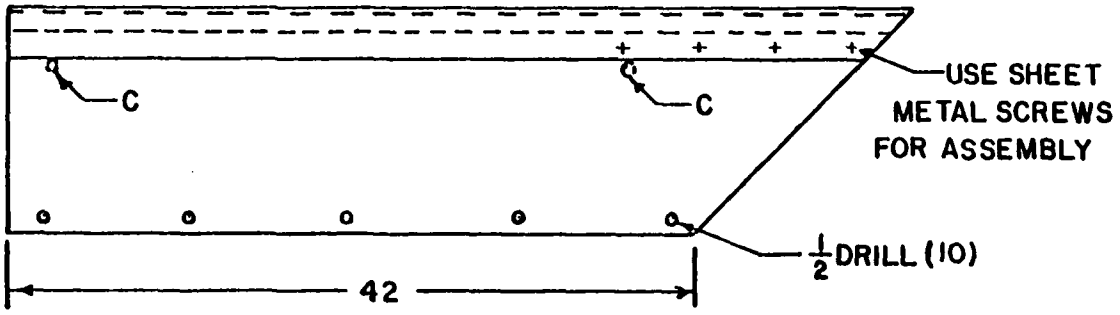




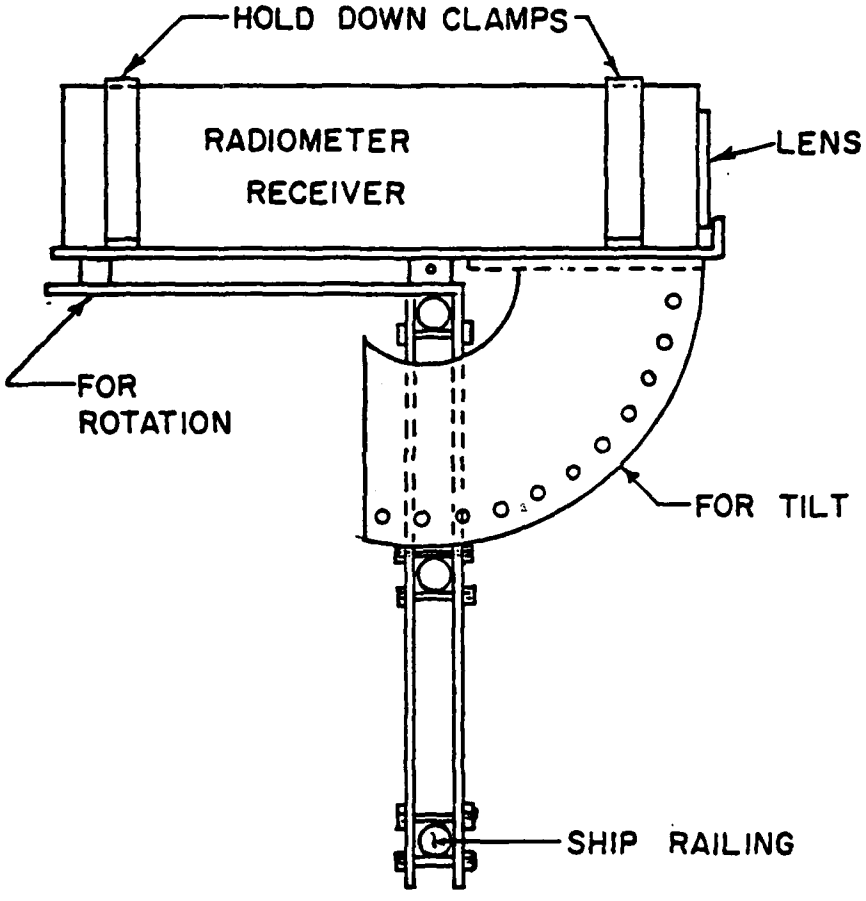
A- 1/16 ALUMINUM, IRIDITE AFTER CONSTRUCTION

B - BEAD FOAM PLASTIC - 1/2

C - ALUMINUM ROD 3/8 D, D&T 10-32 BOTH ENDS (2 TOTAL)



SUN SHIELD – RADIOMETER RECEIVER


HOLD DOWN CLAMPS
RADIOMETER
RECEIVER
LENS
FOR
ROTATION
FOR TILT
SHIP RAILING

PLEASE NOTE:

NO SKETCHES NOR DRAWINGS WERE MADE FOR MODIFICATION TO THE FOLLOWING ITEMS.

THE WORK WAS JUST DONE TO SUIT:

CARRYING HANDLES

TEMPERATURE READOUT CIRCUIT

AIR BLOWER

ELECTRICAL CONNECTING TERMINAL BOARD

WAVE GUIDE CHANGES

TEMPERATURE SENSOR

CHASSIS INSULATION


DAT
FILM